

Institute of Biological Engineering

2008 Annual Conference

**A PLATFORM
FOR PARTNERSHIPS
AND PROGRESS**

08

Surface Plasmon Resonance

Imaging sensors for biomolecular surface interaction characterization.

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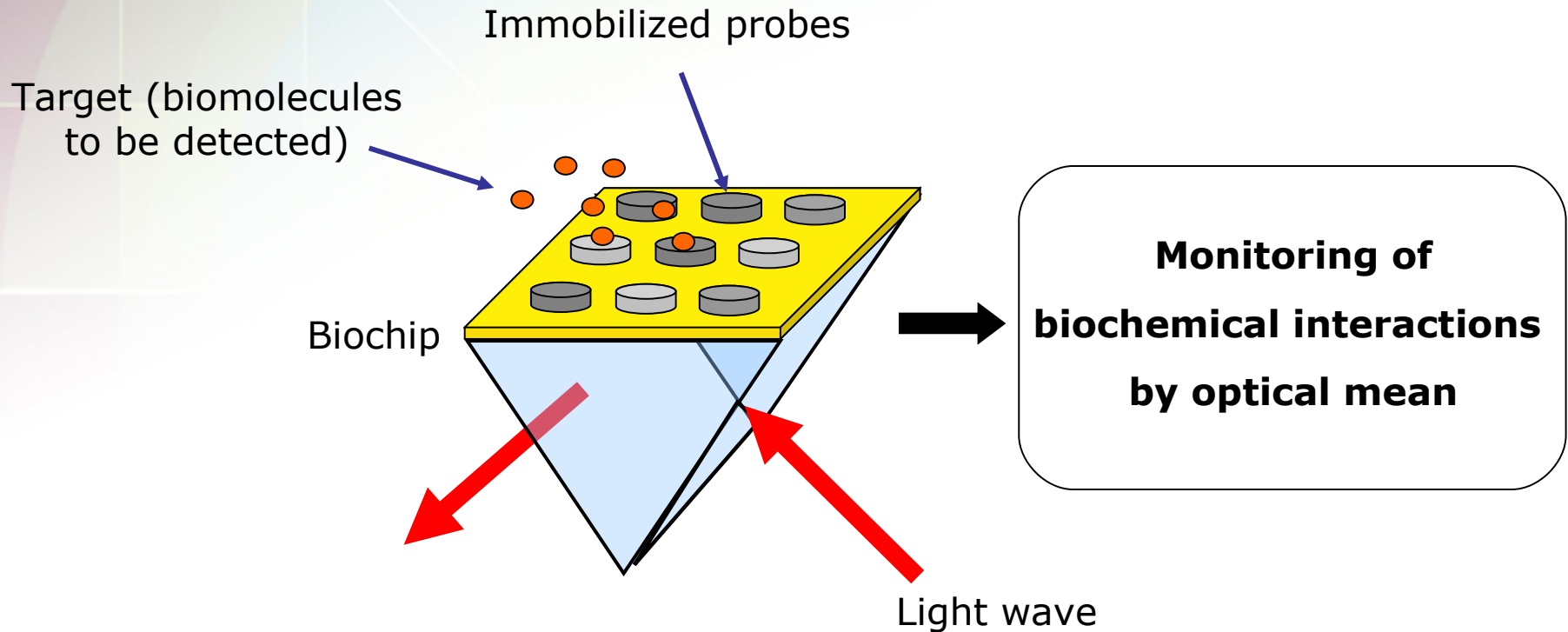
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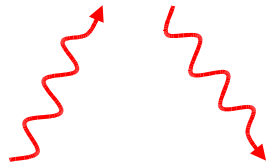




P. Lecaruyer, I. Mannelli, V. Courtois, M. Goossens and M. Canva - "Surface plasmon resonance imaging as a multidimensional surface characterization instrument – application to biochip genotyping" - *Analytica Chimica Acta* **573-574**, 333-340 (2006).

Surface plasmons

Thick gold metallic layer

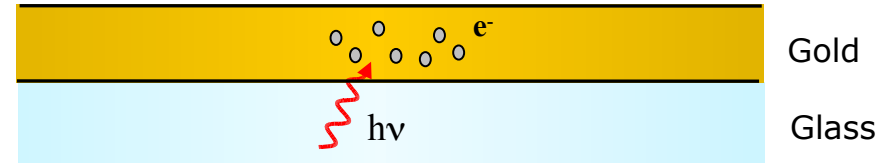


Polarized visible light

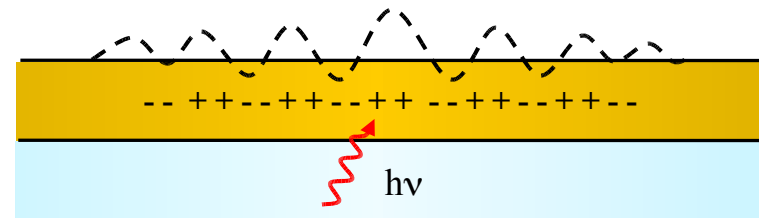
➡ **Total reflection**

~ 50 nm gold layer

Free conduction electrons



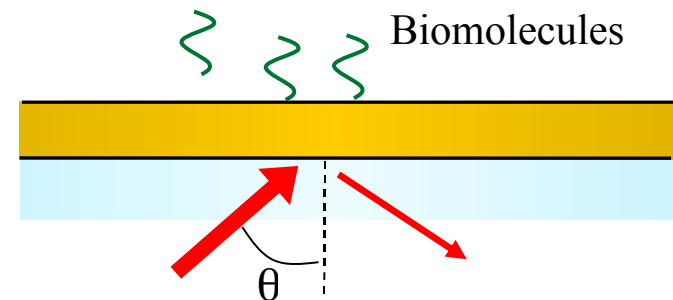
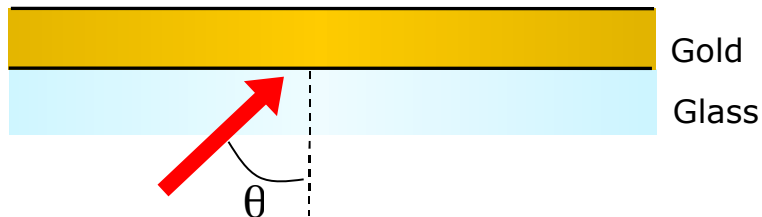
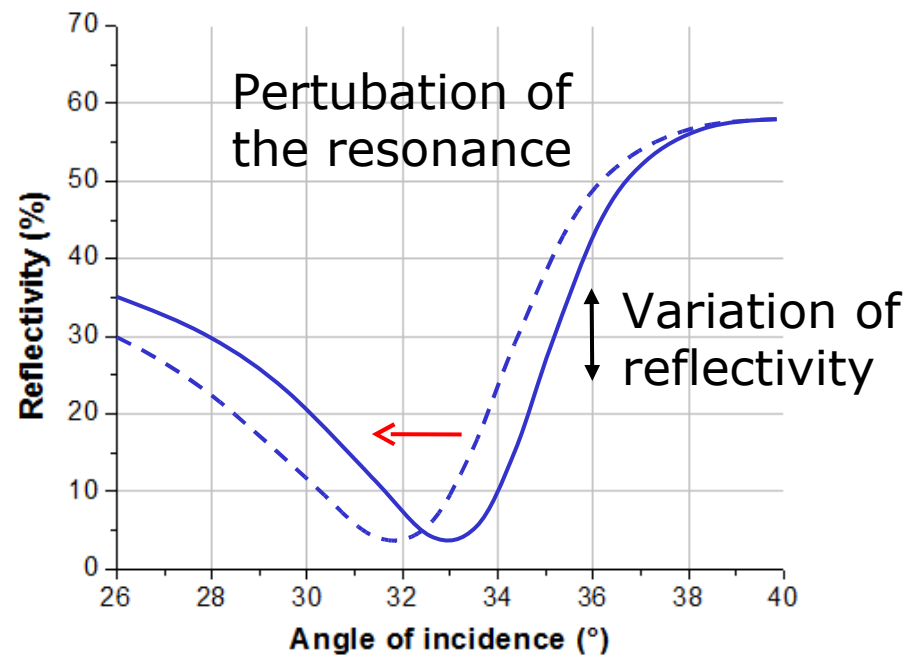
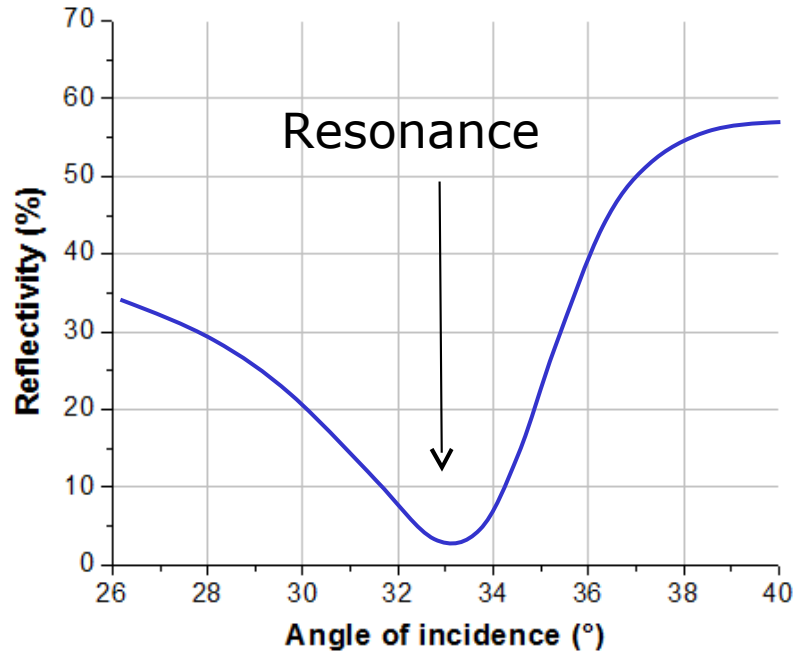
collective oscillation of the electrons

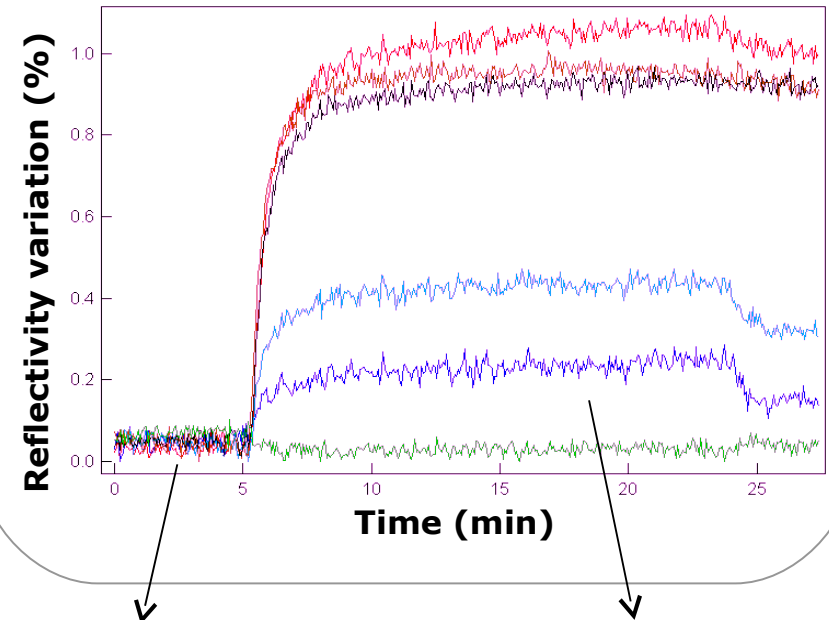
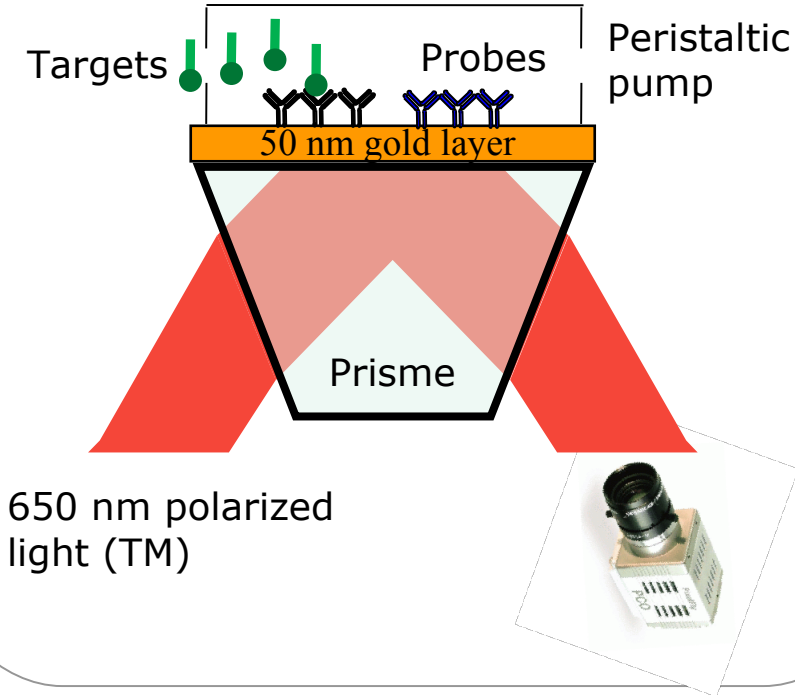


Coupling between :

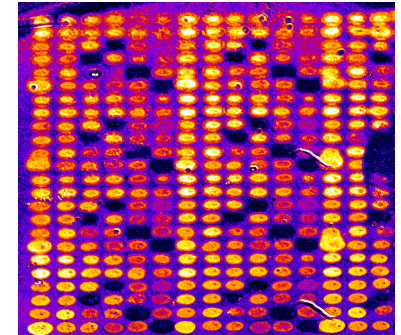
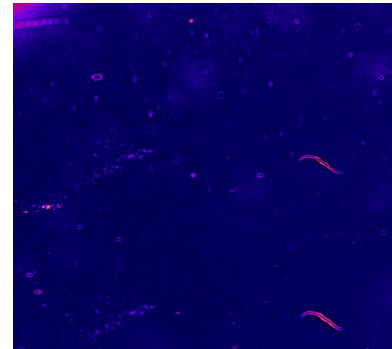
Incident light ➡ Surface Plasmons

Surface Plasmons Resonance (SPR)

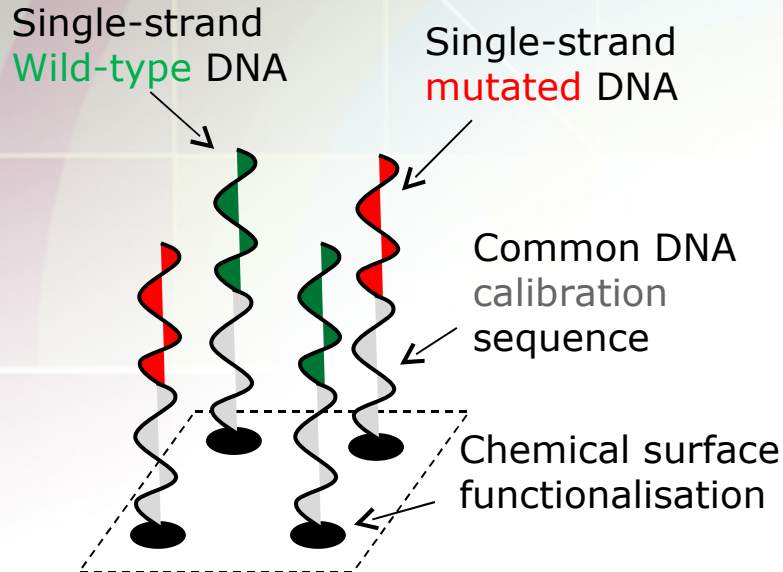




- SPRI sensitivity $\sim 10 \text{ pg/mm}^2$
- **Real time** monitoring of biomolecular interactions
- **Label-free**

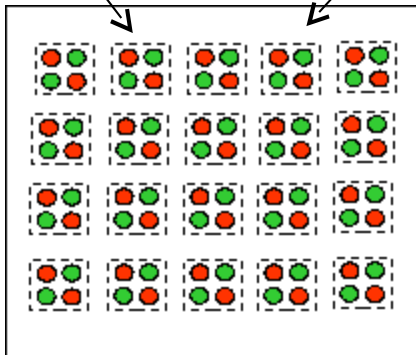


Application to genetic diagnosis

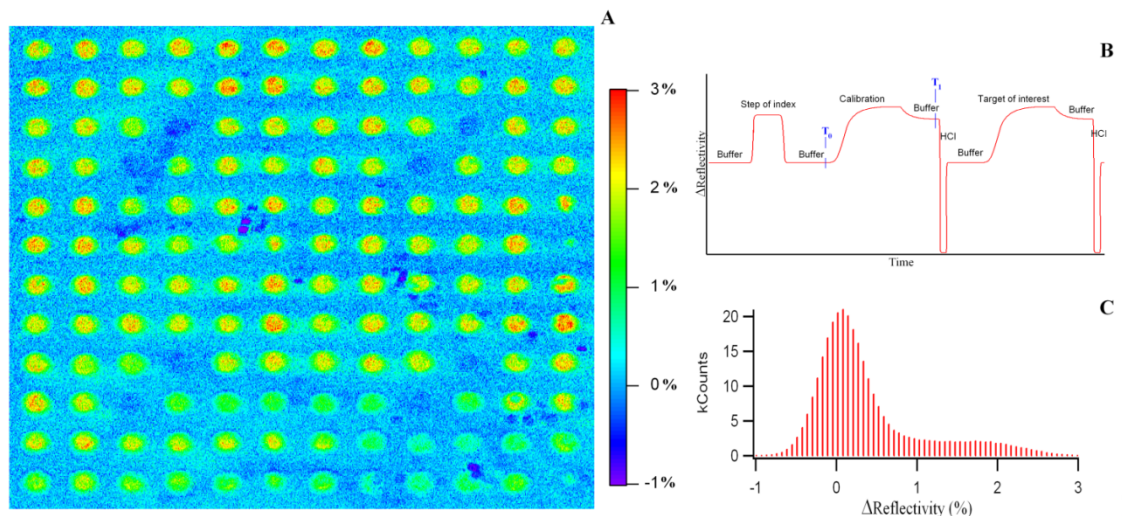


- Biotinylated oligonucleotides probes are attached to a **Dextran polymer monolayer** via an avidin.
- Dispersion in the response of the spots is corrected using a **calibration sequence**

Mutation 1 ... Mutation n



Gold biochip 5 mm x 5 mm

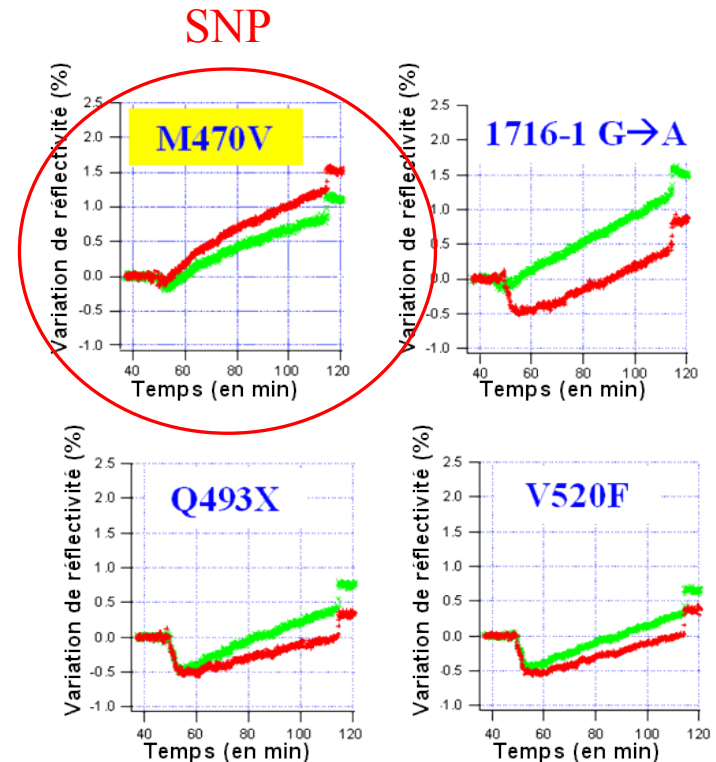
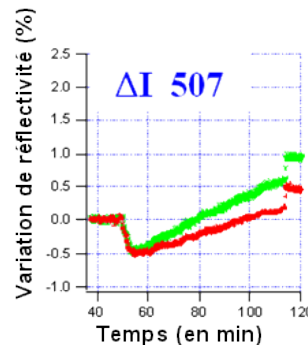
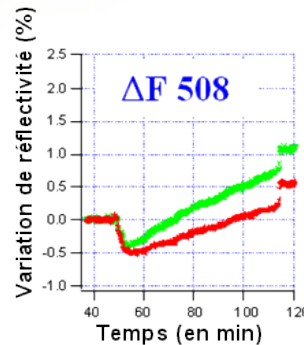


Example of Cystic Fibrosis

Cystic Fibrosis is a hereditary disease leading affecting mainly the lungs and digestive system
Around 1 in 4000 children is born with CF.

Objectives:

- Biochip for the diagnosis of 65 mutations (95% of the case).
- **Fast and low-cost**



Mutations of the Exon 10 of the CFTR gene

Application to p53-DNA interaction

Specific DNA to
p53

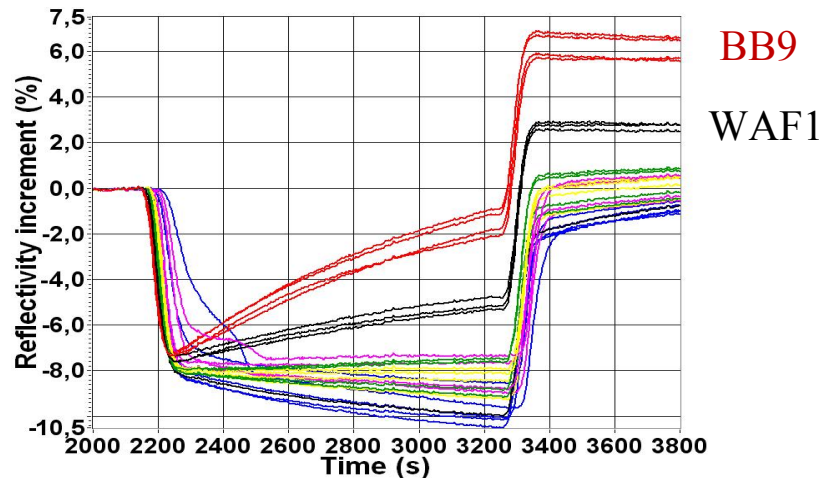
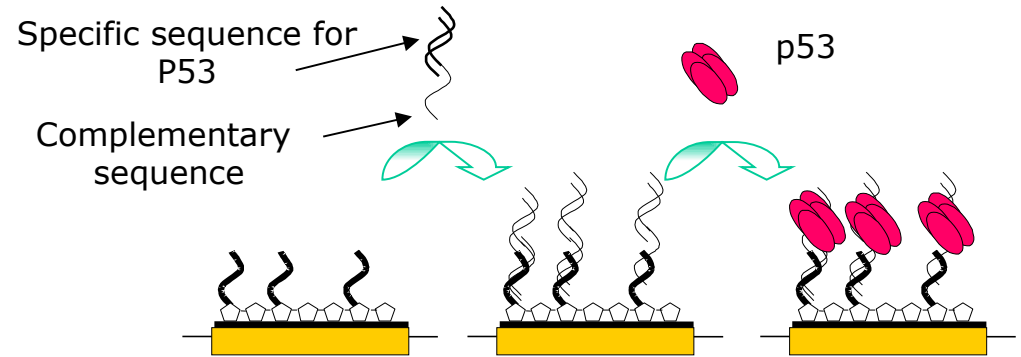


BB9 : 5' GGGCATGTCCGGGCATGTCC 3'
3' CCCGTACAGGCCCGTACAGG 5'

WAF1 : 5' GAACATGTCCCAACATGTTG 3'
3' CTTGTACAGGGTTGTACAAC 5'

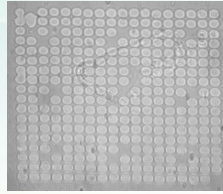
MDM2 : 5' GGTCAAGTTCAGACACGTTT 3'
3' CCAGTTCAAGTCTGTGCAAG 5'

BB9M : 5' GGGCAGGACCGGGCAGGACC 3'
3' CCCCCTCCTGGCCCCGTCCTGG 5'

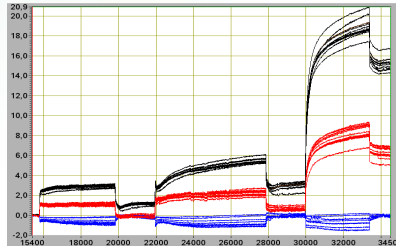


Multi-dimensionnal biochip

2D: spatial x, y

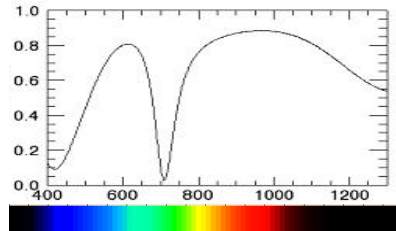


3D: temporal t



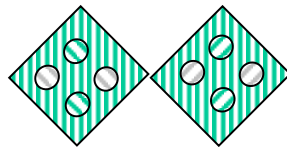
Label-free multiplex detection of
hundred interactions

4D: spectral λ



→ Spectral signature

5D: Polarisation P



→ Anisotropy of
biomolecular systems

Acknowledgements

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Institut d'Électronique Fondamentale,
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GenOptics bio-interactions
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